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Factors Affecting Demand for Dental Implant Treatment: A Population-based Study in the Western Region of Saudi Arabia

Alaa W. Alqutub[1,*], Afnan A. Nassar[2], Ahmed A. Alzahrani[3], Muhnnad A. Balbaid[3] and Majd H. Morad[3]

[1]*Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Umm Al-Qura University, Makkah al Mukarramah, Saudi Arabia*
[2]*Division of Public Health, Department of Preventive Dentistry, Faculty of Dental Medicine, Umm Al-Qura University, Makkah al Mukarramah, Saudi Arabia*
[3]*Faculty of Dental Medicine, Umm Al-Qura University, Makkah al Mukarramah, Saudi Arabia*

Abstract:

Background: Dental implants have improved the quality of life of patients by providing a more acceptable and durable replacement for missing teeth. The knowledge and awareness of patients regarding dental implants, as well as other influencing factors, such as age, gender, and academic level, affect their demand for implant treatment.

Objectives: This study aimed to assess the factors affecting the demand for dental implant treatment in the western region of Saudi Arabia.

Methods: A self-designed, close-ended, and validated questionnaire was distributed to 1,182 participants in this observational cross-sectional study from different cities in the Western region. A total of 834 respondents completed the survey and met the inclusion criteria with 70.55% response rate. A total of 20 questions related to demographic data, implant awareness, and implant demand were included in the survey. The responses were analyzed using spreadsheet software (Statistical Package for Social Sciences, SPSS version 27). The frequency distribution of the responses of the participants was calculated, and the results were drawn. A chi-square test was applied to compare the reported outcomes.

Results: Demographic data showed an equal contribution from both genders, as 50.5% of the sample were male and 49.5% were female. Most of the participants' ages ranged from 30 to 49 years (44.5%). The majority of the sample had a bachelor's degree (52.9%). Almost half of the participants (57%) believed that they had fair dental hygiene. Most of the participants were missing between one and three teeth (66.7%). Forty-one percent of the participants had never replaced their missing teeth. This study revealed that most of the contributors (64.8%) knew about dental implants as a treatment option, and social media was the most statistically significant source of this knowledge (36.7%) ($p = 0.011$). However, their knowledge of this topic was limited, as 78.2% believed they needed more awareness regarding dental implants. Only 17% of the sample had replaced their missing teeth with dental implants, with a statistically significant gender difference in demand where females reported higher demand than males ($p = 0.003$). The financial burden was the most significant reason ($p = 0.001$) not to consider dental implants (42%). On the other hand, the main reason that participants reported having considered implants was to improve the ability of mastication (51%), and this finding was statistically significant ($p = 0.001$).

Conclusion: The results of the study show that the need to improve mastication was the main reason for the demand for dental implants. On the other hand, the cost was the main reason that participants did not consider dental implants. In general, people in the western region of Saudi Arabia are aware of dental implants. However, there is a need to increase their knowledge about dental implants as a treatment option to replace missing teeth.

Keywords: Dental implant, Implant demand, Knowledge, Awareness, Treatment options, Missing teeth, Patient education.

* Address correspondence to this author at the Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Umm Al-Qura University, P.O. Box 715 Makkah al Mukarramah, 24238, Saudi Arabia; Tel: +966 553 353 365; E-mail: awqutub@uqu.edu.sa

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1. INTRODUCTION

Dental implants are structures formed of alloplastic materials that are inserted into the oral tissues through the bone beneath the mucosa to give a fixed or removable dental prosthesis for support and retention [1]. Dental implants have been shown to improve the quality of life of patients and their masticatory functions [2]. Overall, both aesthetically and functionally, implant-supported restorations are rated very highly by patients. The majority of patients expressed great satisfaction with the stability, cleanability, and comfort of their restoration while chewing, in addition to their phonetics [3].

The loss of one or more natural teeth frequently causes impairments because it affects basic everyday functions, such as speaking and eating [4]. It also reduces social engagement because wearing dentures can cause embarrassment [5]. Anatomical, physiological, psychological, and prosthodontic factors may explain why a large number of patients have difficulty adapting to removable prostheses. Functional tests have revealed that subjects with removable prostheses have lower masticatory ability than dentate controls. Even with the best prostheses, many patients struggle with denture retention, speech, and mastication [5]. The most common factors that deter patients from selecting implants are expense, length of therapy, and surgical anxiety. The word “surgery” in reference to implants leads some patients to believe that getting dental implants is a critical surgical procedure [4]. As financial circumstances and patient preferences play a significant role in most situations, there are no established guidelines for estimating the need, demand, or utilization of prosthodontic services [6].

It is important to assess the level of knowledge and awareness of patients regarding the possibility of getting dental implants to replace missing teeth [7]. According to the literature, factors including age, education level, and the number of natural teeth in the mouth influence the need of patients for implant-supported prostheses [8]. The main reason patients demand dental implants is to improve their quality of life, while cost is the main reason they choose not to get dental implants [8]. Patients’ degree of knowledge of dental implants as a treatment option to replace missing teeth is currently below expectations, and many patients lack the information necessary to make an informed choice about replacing missing teeth [9]. Patients can be informed of the treatment modalities for lost teeth, starting with fixed partial dentures (FPDs), removable partial dentures (RPDs), complete dentures (CDs), and dental implants. Patient knowledge of dental implants is currently limited [10].

Up to 16 years after the initial implant, 82.94% of patients have cumulative success with their placed dental implants [11]. Determining the success of dental implants depends on many prognostic factors, such as systemic health, dental habits, and plaque control, as well as implant size, site, surgical procedures, and loading procedures [12]. Dental implants have had increased acceptability and interest in Saudi Arabia as a treatment modality to restore missing teeth [13].

Our study aims to assess population awareness and the factors affecting the demand for dental implant treatment among the population in the Western region of Saudi Arabia, such as age, gender, and educational level. The resulting data will evaluate the need of the population for dental implants as an option to replace their missing teeth. Also, it will reflect their knowledge about dental implants and the educational need to enrich their perception.

2. MATERIALS AND METHODS

2.1. Study Design

This is an observational cross-sectional study conducted between August 2023 and October 2023. A convenience sampling method was used to select a sample from the general population of the Western region of Saudi Arabia.

2.1.1. Ethical Consideration

The study was in full agreement with the World Medical Association Declaration of Helsinki guidelines. Ethical approval was obtained from the Biomedical Research Ethics Committee at Umm Al-Qura University (UQU) (Approval No: HAPO-02-K-012-2023-04-1559).

2.1.2. Participants

A close-ended and validated questionnaire was constructed and published in the literature with minor modifications to fit the context of our study. To ensure content validity, the modified questionnaire was reviewed by a panel of experts in the field for relevance and clarity, slight adjustments to the wording, and the removal of redundant items. The final version of the questionnaire consisted of four sections (demographics, oral hygiene practices and dental history, knowledge about dental implants, and implant demand) and was translated into Arabic to ensure accessibility for the target population. The online version was created using Google Forms to enable ease of access.

Preceding data collection, a pilot test was conducted with a sample of 25 participants, similar to the study population, to evaluate the questionnaire's comprehensibility and response accuracy. The questionnaire was further refined for clarity based on the pilot test results.

To assess the reliability of the instrument, the test-retest method was employed. The questionnaire was administered to the same group of participants with a time interval of two weeks. The Cronbach's alpha value of 0.8, obtained from the test-retest results, indicated a high level of internal consistency and reliability.

The study included subjects aged 18 years and older who were able to read and understand Arabic, resided in the Western region of Saudi Arabia, and had at least one edentulous space. The sample size was determined using a sample size calculator, which indicated a minimum requirement of 365 participants; ultimately, 1,182 were invited to complete the study questionnaire (Sager guidelines were followed).

2.1.3. Statistical Analysis

Responses were entered and analyzed using spreadsheet software (Statistical Package for Social Sciences, SPSS version 27). The frequency distribution of the participants' responses was calculated, and the results were drawn. A chi-square test was applied for reporting correlations, and $P < 0.05$ was considered statistically significant.

3. RESULTS

The online survey was distributed to a total of 1,182 participants from different cities in the western region. A total of 834 respondents signed electronic informed consent, completed the survey, and met the inclusion criteria, resulting in a response rate of 70.55%.

Demographic data collected from the participants and their demand for implant treatment are presented in Table **1**. People who lived in the city of Jeddah constituted the highest proportion of people who completed the surveys, 357 (42.8%), and also the highest in demanding dental implant replacement compared to others who lived in different cities (p=0.004). Equal contribution from both genders was observed, as 421 (50.5%) of the sample were male and 413 (49.5%) were female. However, a significant difference was reported where females had a higher demand for implant treatment compared to males (p=0.003). Most of the participants' ages ranged from 30 to 49 years, 371 (44.5%). In regards to age and demand, a significant difference (p=0.001) was found among the age groups, where the lowest demand was recorded among those 18-29 years of age. The majority of the sample, 441 (52.9%), had a bachelor's degree, while those with postgraduate degrees showed significantly higher demand for dental implants compared to others (p=0.001) (Table **1**).

Table 1. The demand / nondemand for dental implants based on age, academic level, city and gender.

Parameter	Having Demand for Dental Implant	Having no Demand for Dental Implant	*P-value*	Total
Age (years)				
18-29	40 (14.1%)	242 (85.9%)	0.001	282(100%)
30-49	72 (24%)	299 (76%)		371(100%)
50-64	33 (27.7%)	119 (72.3%)		152(100%)
≥65	5 (17.2%)	24 (82.8%)		29(100%)
Academic Level				
Primary school	1 (14.2%)	6 (85.7%)	0.001	7(100%)
Middle school	16 (21.6)	58 (78.4%)		74(100%)
High school	33(14.2%)	198 (85.8%)		231(100%)
Diploma	0 (0%)	15 (100%)		15(100%)
Bachelor's	77 (17.4%)	364 (82.5%)		441(100%)
Higher diploma	0 (0%)	1 (100%)		1(100%)
master, PhD	16 (26.6%)	44 (73.3%)		60(100%)
none	0 (0%)	5 (100%)		5(100%)
City				
Makkah	40 (14.4%)	237 (85.5%)	0.004	277(100%)
Al Madinah	8 (7.8%)	94 (92.1%)		102(100%)
Jeddah	84 (23.5%)	273 (76.4%)		357(100%)
Al Taif	14 (18.1%)	63 (81.8%)		77(100%)
Yanbu	4 (19%)	17 (81%)		21(100%)
Gender				
Male	56 (13.3%)	365 (86.7%)	0.003	421(100%)
Female	94(22.7%)	319 (77.2%)		413(100%)

Table 2. Participants' response to dental history questions.

Dental History		n (%)
How do you rate your level of interest in dental hygiene?	Excellent	272(32.6)
	Fair	475(57)
	Poor	87(10.4)
How many missing teeth do you have? (Not including the wisdom teeth)	1-3 missing teeth	556(66.7)
	4-7 missing teeth	190(22.8)
	8 teeth or more	65(7.8)
	A whole arch without any teeth	23(2.8)
Where are the missing teeth located?	Frontal region (Anterior teeth)	76(9.1)
	Back region (posterior teeth)	604(72.4)
	I have more than one tooth missing in the frontal and back regions	154(18.5)
Did you replace your missing tooth/teeth before?	Yes, I did	188(22.5)
	No, I didn't	304(36.5)
	I am considering the treatment	342(41)
If you answered yes, or if you are considering treatment, what is/was the dental treatment?	I didn't replace my missing teeth yet.	304(36.5)
	Fixed prosthesis (crown, bridges)	211(25.3)
	Removable prosthesis (partially edentulous)	68(8.2)
	Removable prosthesis (completely edentulous)	19(2.3)
	Dental implants	150(18)
	The space was closed by ortho treatment	82(9.8)

Table 3. Participants' awareness assessment regarding dental implant treatment.

Awareness Assessment		n (%)
Do you know what dental implant is?	Yes	624(74.8)
	No	210(25.2)
If you answered yes, where did you get your knowledge from about dental implants? (choose all that applies)	I do not know about dental implant	210(25.2)
	Dentist	304(36.5)
	Friends and family	222(26.6)
	Social Media	306(36.7)
	Others	92(11)
Do you think that you need more awareness about dental implant?	Yes	652(78.2)
	No	182(21.8)
Do you think missing teeth should be replaced?	Yes, always	667(80)
	No, not a necessary	59(7.1)
	I don't know	108(12.9)
If you answered yes, when do you think missing teeth should be replaced?	It's not necessary to be replaced.	49(5.9)
	As soon as they are lost.	298(35.7)
	Whenever they make esthetic or functional problem.	332(39.8)
	I don't know.	155(18.6)
Did you get medical advice specific to your condition from a dental implant specialist?	Yes	324(38.8)
	No	510(61.2)
Do you know the average cost of one tooth implant?	Yes	411(49.3)
	No	423(50.7)

Participants were asked about their oral hygiene practices as part of their dental history Table **2**, and almost half of the participants, 475 (57%), believed that they had fair dental hygiene. Most of the participants had one to three missing teeth, about 556 (66.7%), and the missing teeth were mostly posterior, about 604 (72.4%). Forty-one percent of the participants had never replaced their missing teeth, and the majority of those who replaced their missing teeth or considered replacement had chosen fixed prostheses as their treatment of choice, 211 (25.3%), compared to 150 (18%) who considered dental implants (Table **2**).

Knowledge of the respondents is summarized in Table **3**. The responses showed that the majority of participants, 624 (64.8%), had knowledge about dental implants. When asked about the source of this knowledge, the most statistically significant sources were social media, 306 (36.7%), and dentists, 304 (36.5%) ($p = 0.011$, $p = 0.003$ respectively). Interestingly, the majority, 652 (78.2%), believed that they needed more awareness about the dental implant treatment procedure. Eighty percent of the participants believed that they should always replace their missing teeth, and 332 (39.8%) agreed that the reasons to replace teeth were aesthetics or when the chewing of food was affected. Of the

respondents, 510 (61.2%) had not received medical advice specific to their condition from a specialist in dental implants, and about half of the participants, 423 (50.7%), were not aware of the average cost of a single implant (Table **3**).

The demand for dental implants in the community was investigated, and only 17% of the sample had used dental implants to replace a missing tooth. The main motive for considering implants was to improve the ability of mastication (51%) (Fig. **1**). There was no statistically significant difference between genders or between different academic levels of the participants regarding their reasons for choosing dental implants. However, the age factor showed a difference where the main reason for participants aged ≥65 to choose an implant was to increase their ability to chew food (p=0.001) compared to those aged younger, where aesthetics was the main factor followed by mastication.

Financial obligations and the cost of the implant treatment were significantly reported as the major reasons among 41.9% of participants for not considering dental implants for replacing missing teeth (p = 0.001) (Fig. **2**). This finding was found among all age groups, especially among the youngest group (18-29), and equally presented as the reason among both genders.

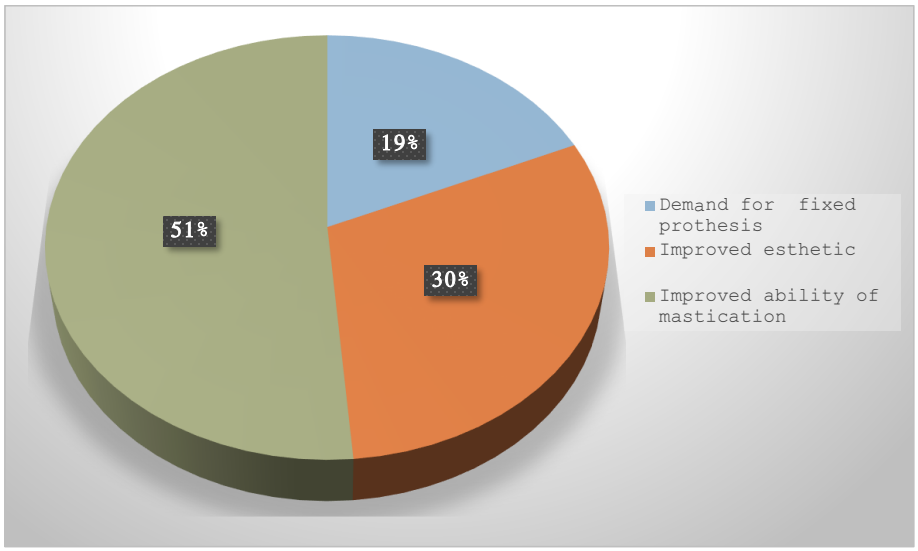

Fig. (1). The reasons for demanding dental implants.

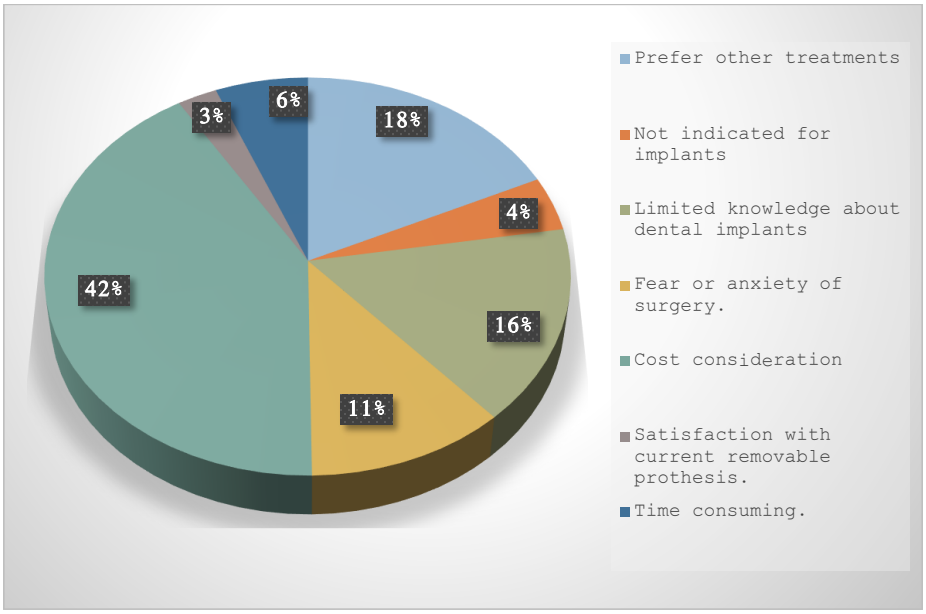

Fig. (2). The reasons for not demanding dental implants.

4. DISCUSSION

This study aimed to assess population awareness and the factors affecting demand for dental implants in the western region of Saudi Arabia. The factors investigated included demographic data, dental history, awareness assessment, and implant demand assessment. The study found that the majority of the participants had one to three missing teeth in the posterior region. This finding is in line with a study conducted by Aljafar et al., in which the most frequently extracted teeth were found to be the mandibular and maxillary molars. They also reported that posterior teeth morphology, early time of eruption, and inaccessible position in the oral cavity for proper cleaning were the main reasons for increased molar extraction. They stated that tooth loss significantly increased with increasing age [14].

Our results showed that most of the participants believe that missing teeth should always be replaced or restored. Thirty-six percent believe that missing teeth should be replaced immediately after their loss, and 40% think that they should be replaced only when the loss affects aesthetics or function. In a study conducted by Kinani et al., [15] 80% of the respondents considered the replacement of missing teeth to be very important, compared to 20% who reported that replacing missing teeth is not important at all

The present study found that 75% of the participants generally knew about dental implants as a treatment option to replace missing teeth, and social media and dentists were the main sources of their information. However, the majority reported the need for more education about implants as a treatment option, signifying the need to incr-ease awareness of dental implants in the western region of Saudi Arabia.

A similar study conducted in the Jazan region of Saudi Arabia about public awareness of dental implants showed good knowledge, as 80% of the population was well informed about dental implants, with only 40% aware of the advantages of implants for replacing missing teeth. Their source of information was mainly their dentists, whereas only 5–7% obtained their information from social media [15]. A study conducted to assess public awareness of dental implants in India found that 74.8% of participants were aware of this option for replacing lost teeth. It was reported that the media was the main source of information for dental implants, followed by dentists [16, 17]. Another study found that information about dental implants was provided by dentists to only 20% of the participants [18].

The results of the present study also indicate that the most common reason for demanding dental implants was function and improved ability of mastication. According to Gupta et al., functional requirement was also the most common reason for tooth replacement after extraction [19]. This finding is in line with those of other studies, which have reported the preference of patients for fixed prostheses for both aesthetic and functional reasons [20, 21]. A study conducted by Srinivasan et al. to test the satisfaction and masticatory function of patients concluded that implant-supported fixed restoration resulted in better masticatory function, and there is a strong relation between patients' perception of masticatory capacity improvement and the improvement of masticatory performance and satisfaction index [22].

It was found that both maximum bite force and the food comminution index were significantly higher in patients using implant-supported fixed dental prostheses and implant-supported removable dental prostheses compared to those using conventional removable prostheses [23]. Additionally, the use of implants was associated with increased masseter muscle thickness during contraction, indicating enhanced muscle function [24].

The commonly reported reason for not demanding dental implants in our study was the high treatment cost, followed by participants' preference for other treatment options, such as FPD and ortho treatment. However, about half of the participants did not know the average cost of a single dental implant. A study conducted in Riyadh city to assess patients' willingness to pay for a dental implant reported that the median cost of a single implant in Riyadh city is about 3000 SR (1 SR = 3.77 US$) [25]. However, no study has reported the average cost in the Western region. They also reported that the majority of the patients were willing to pay the median price for an implant, and that was significantly influenced by the patient's income, age, and setting of the practice. This may be related to the difference in the average income of individuals working in Riyadh and the Western region. Moreover, it has been reported that there is a positive association between income and willingness to pay throughout the literature [25].

To reduce bias associated with cross-sectional studies, this current study used random stratified sampling methods to ensure a representative sample, with the use of valid and reliable measurement tools and standardized data collection procedures. Although equal contributions from both genders in this study make the findings somewhat generalizable, the study explored the demand and knowledge about dental implants in the Western region only. Therefore, the findings cannot be generalized to populations in other Saudi Arabian regions. A larger multi-regional study would be more representative of the demand in Saudi Arabia. Also, the data are self-reported and thus subject to biases.

CONCLUSION

The results show that the demand for dental implants is affected by age, gender, and academic level. The majority of the population had no demand for dental implants, and the cost was the main reason for not demanding implants. On the other hand, the need for improved function and mastication was the main reason for demanding implant treatment. A large segment of society knows about dental implants; however, there is a need for further education to increase the awareness of dental implants as a treatment option to replace missing teeth.

AUTHORS' CONTRIBUTIONS

A.Al.Q., A.N., A.A., M.B.: Study conception and design; A.A.:, M.B., M.M.: Data collection; A.Al.Q., A.N., A.A.: Analysis and interpretation of results; A.Al.Q., A.N.: Draft manuscript. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

FPDs	=	Fixed Partial Dentures
RPDs	=	Removable Partial Dentures
CDs	=	Complete Dentures

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Biomedical Research Ethics Committee, Umm Al-Qura, Makkah al Mukarramah, Saudi Arabia (Approval No: HAPO-02-K-012-2023-04-1559).

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Participation (signed electronic) informed consent was implied by completing the survey.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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